

A system is described that permits high-speed, high-resolution mapping of thicknesses (or other properties) of layers on patterned semiconductor wafers. The system comprises one or more spectrometers that each simultaneously image a plurality of spatial locations. In one example, the spectrometer comprises a two-dimensional CCD imager with one axis of the imager measuring spectral data and the other axis measuring spatial data. Spectral reflectance or transmission of the patterned wafer under test is obtained by passing the wafer under (or over) the imaging spectrometer(s) and taking sequential reflectance or transmission images for successive pluralities of spatial locations. The resulting spectral reflectance or transmission map can then be analyzed at discrete locations to determine the thicknesses or other properties of the layers at those locations.